

In-plant Study Demonstrating the Efficacy of Multiple Interventions to Demonstrate Overall Reduction of Microbial Load

Michael Starnes, Ariana Roldan, Andres Martinez, Markus Miller , and Mindy Brashears

International Center for Food Industry Excellence, Department of Animal and Food Sciences, Texas Tech University, Lubbock, Texas, United States

*Corresponding author email: micstarn@ttu.edu

INTRODUCTION

Surrogate strains of *E.coli* that are non-pathogenic and mimic the behavior of pathogenic *E.coli* were developed by researchers to test the effectiveness of in-plant treatments in beef production facilities (1). While treatments can be tested for their efficacy within a laboratory setting, testing within the actual processing facility gives a much more accurate representation of overall cleanliness (2). Every possible condition within a processing facility cannot be accurately replicated within a laboratory, so it is critical to verify treatment effectiveness within the processing facility that will be utilizing the intervention. Currently, there exists no industry standard for the measuring of the 5-log reduction in raw products, and this project looked to validate the treatments applied to beef carcasses that reduce microbial load and create that standard operational procedure for such testing and validation.

OBJECTIVE

This in-plant study was conducted to create a standard operational procedure for the validation of antimicrobial treatments within a beef processing facilities using surrogate strains of bacteria. This study also compared the level of microbial attachment at different inoculation sites, as well as comparing two mediums used to swab carcasses.

RESULTS

Day 1 attachment levels were 7.43 log, with interventions yielding a 5.76 log reduction. Day 2 attachment levels averaged to 7.54 log, with interventions yielding a 2.24 log reduction, resulting in a 8.0 total reduction achieved when combining both days of treatments. When comparing a MicroTally mitt against a 25 ml prehydrated sponge, no statistical difference was observed ($p=0.255$). When comparing inoculation sites, the inner foreshank showed no statistical difference, as combined day one and day two data yielded a p-value of 0.677.

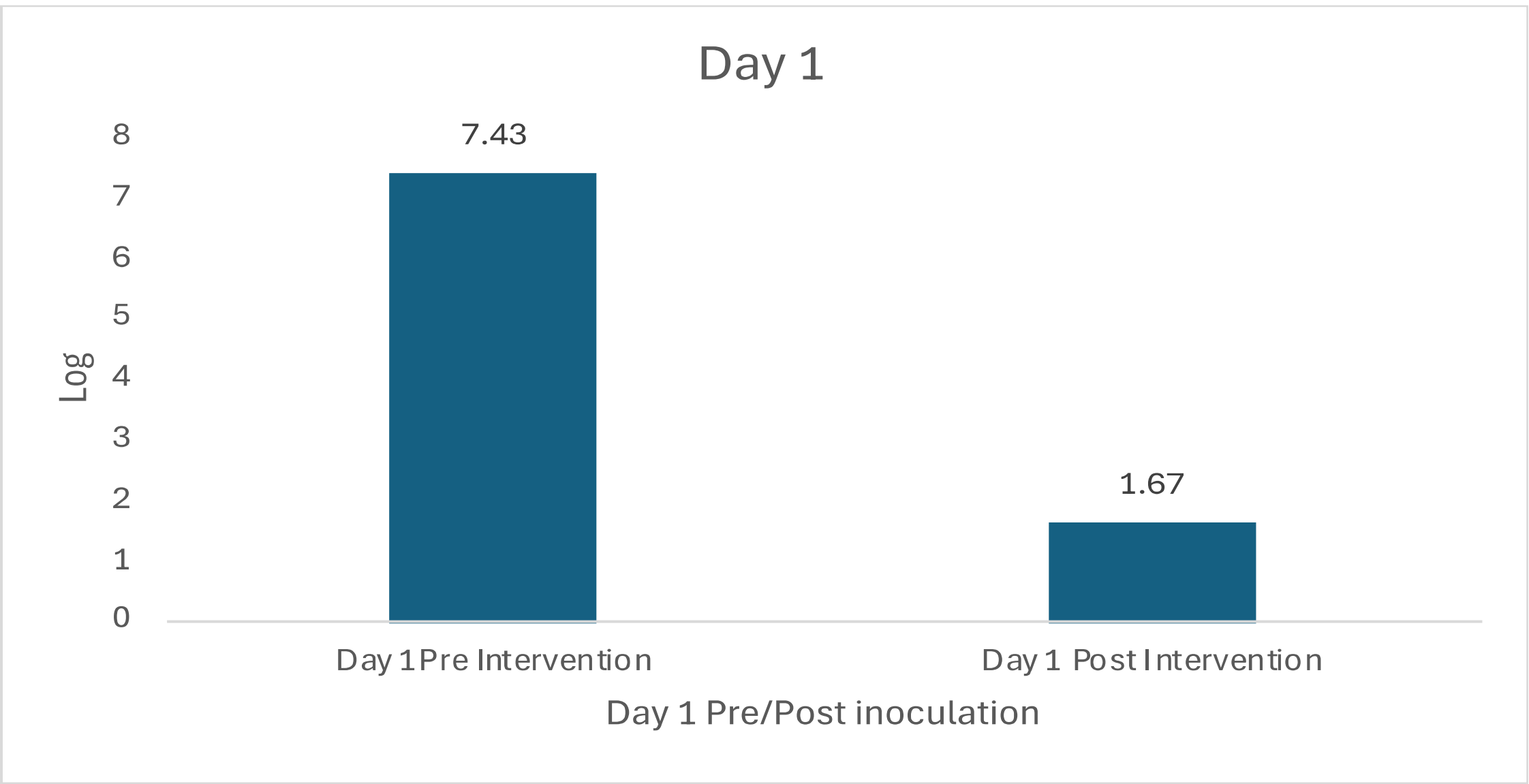


Figure 3: Day One Pre and Post Intervention Numbers

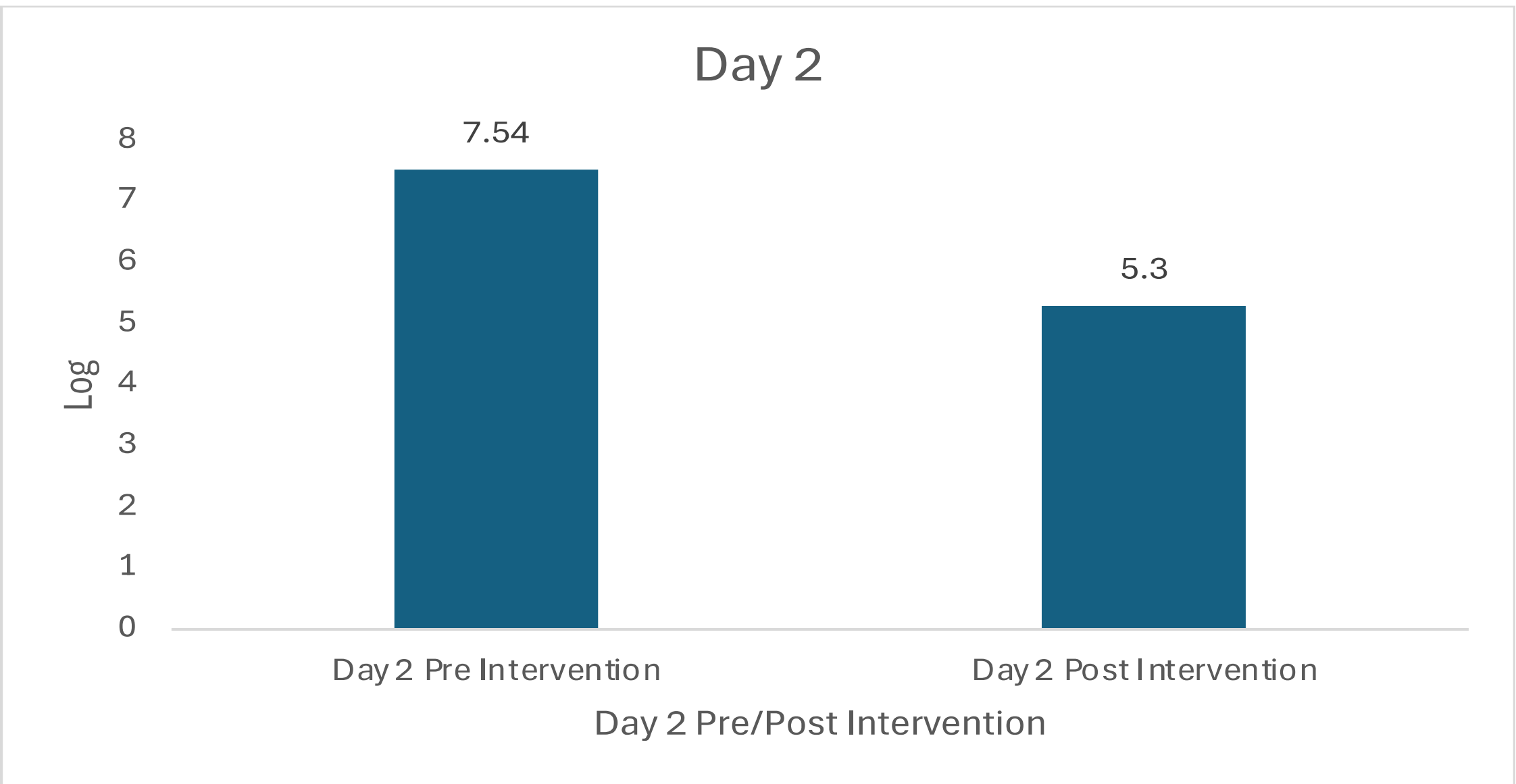


Figure 4: Day Two Pre and Post Intervention Numbers

CONCLUSIONS

Based on the findings in this study, an 8-log reduction from all combined interventions was achieved to prevent microbial growth and kill potential contaminants. The sampling showed a consistent level of microbial reduction, with day one treatment clearly showing a higher level of effectiveness than day two. Sponge vs MicroTally cloth comparisons showed no statistical difference, as did the inner and outer foreshank comparison. All in all, the operational procedure replicated during each repetition yielded consistent results for a clear demonstration of intervention efficacy. This standard of operation is replicable industry wide for antimicrobial treatment validation.

MATERIAL AND METHODS

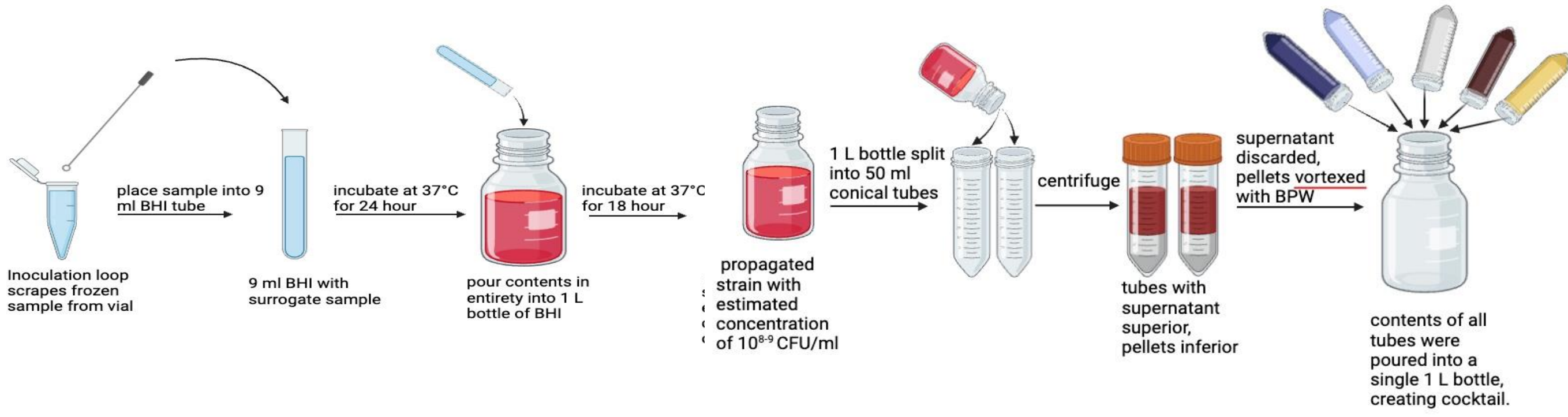


Figure 1 : Initial propagation of surrogate strains of *E. coli* strains BAA 1427-1431. Strains were propagated from frozen cultures, grown in BHI bottles, centrifuged, and combined to create a cocktail that was frozen at the Texas Tech University Meat Laboratory.

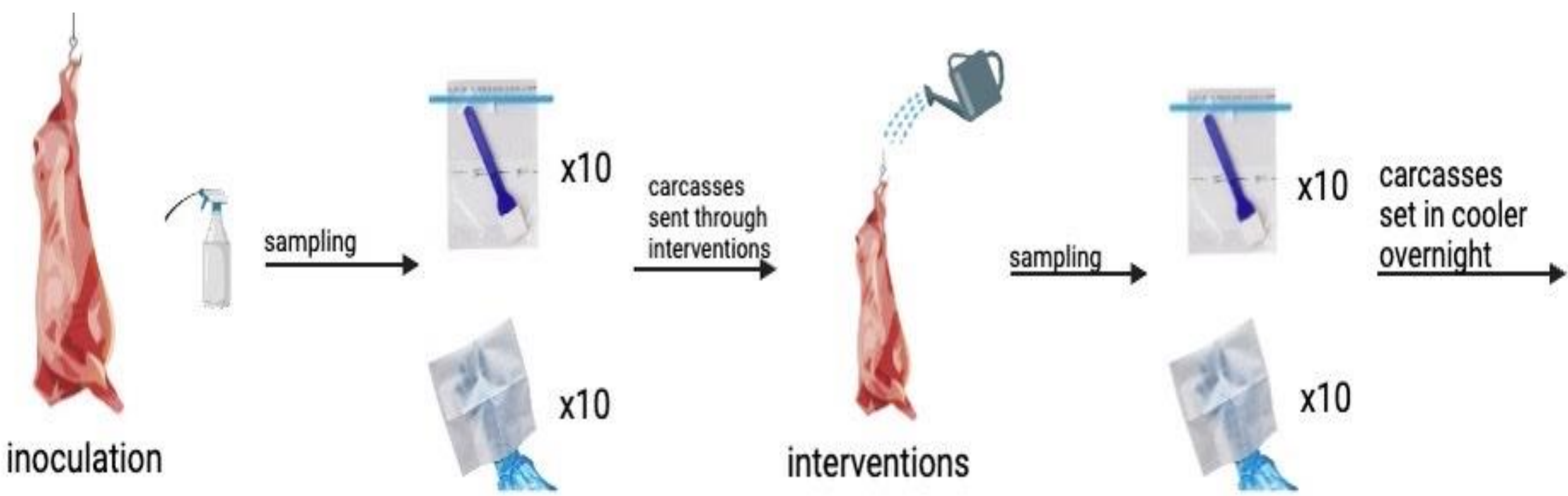


Figure 2: Day 1 Sampling Procedure: Day 1 sampling procedure followed to successfully inoculate and collect samples from foreshanks containing the applied surrogate cocktail.

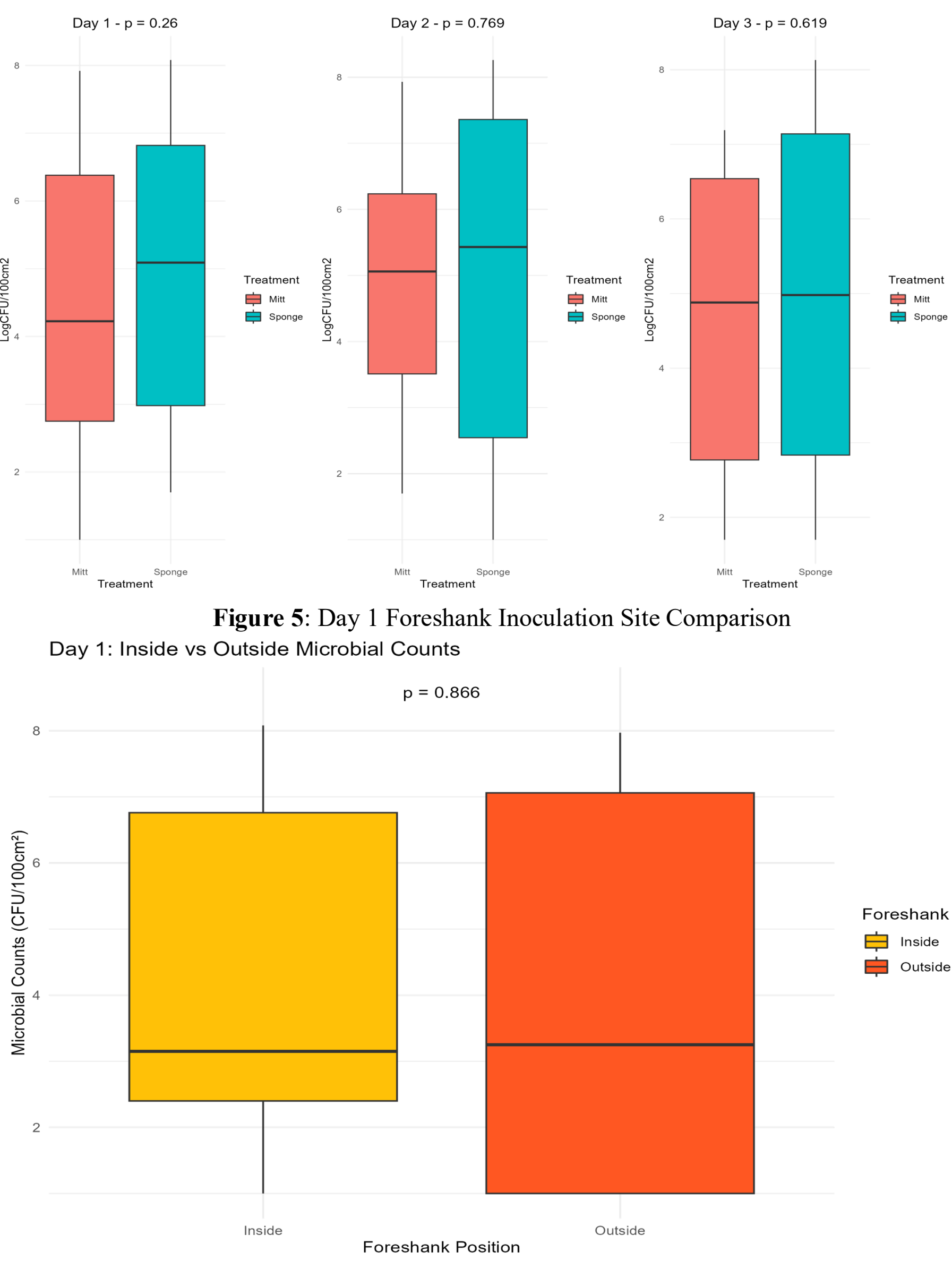


Figure 5: Day 1 Foreshank Inoculation Site Comparison

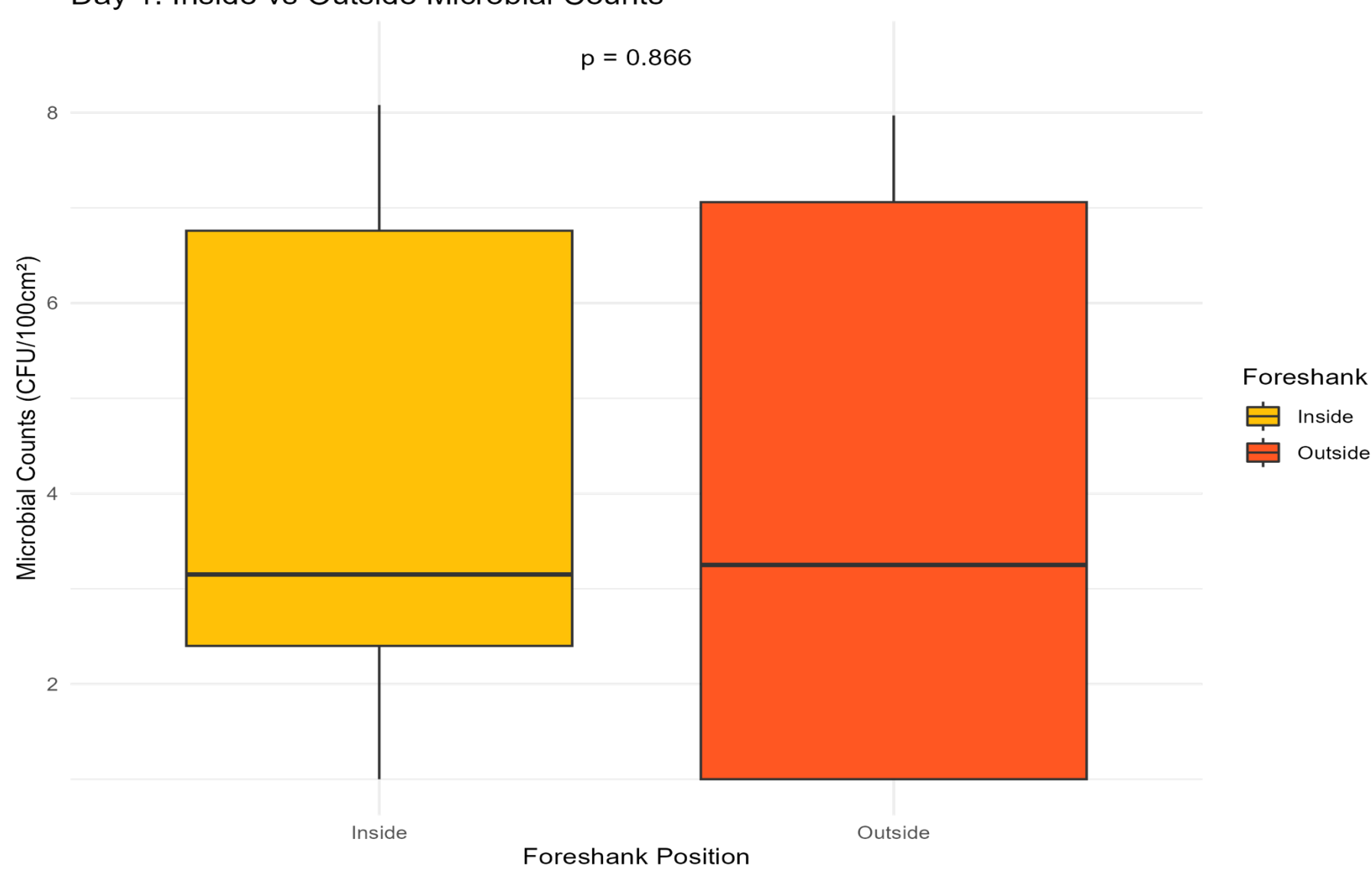


Figure 6: Microtally Mitt vs 25 ml BPW sponge comparison

REFERENCES

1. K.M. Marshall, S.E. Niebuhr, G.R. Acuff, L.M. Lucia, J.S. Dickson, Identification of Escherichia coli O157:H7 Meat Processing Indicators for Fresh Meat through Comparison of the Effects of Selected Antimicrobial Interventions, Journal of Food Protection, Volume 68, Issue 12, 2005, Pages 2580-2586, ISSN 0362-028X,
2. Hu, Mengyi, Gurtler, Joshua. "Selection of Surrogate Bacteria for Use in Food Safety Challenge Studies: A Review" Journal of Food Protection 80, no.9 (September 2017): 1506-36.

ACKNOWLEDGEMENTS

Funding was provided by the International Center for Food Industry Excellence (ICFIE).

